

# Characterization of the Georgia Basin/Puget Sound Airshed

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## Abstract

Representatives from all levels of government, from First Nations and Tribes have started to develop a comprehensive international air quality management plan for the Pacific Northwest. One of the products of these meetings is a Statement of Intent that describes activities deemed to be of high priority for international air quality planning. The Characterization of the Georgia Basin/Puget Sound Airshed is one of these activities. The focus of this "characterization" is ground level ozone, fine particulate matter and visibility. These three components of the air quality picture fit very well with the immediate policy needs within the airshed. Policies being dealt with include the Regional Haze Rule, implementation of new ambient air quality standards for fine particulate matter and ground level ozone (Canada Wide Standards), the Ozone Annex (2004) and a possible PM Annex (2005).

The Characterization of the Georgia Basin/Puget Sound Airshed will provide a clear and comprehensive analysis of the past and present air quality conditions within the Georgia Basin/Puget Sound Air Basin and clearly identify the impacts on ambient air quality conditions within the Basin resulting from policy and planning strategies and natural processes. The study will be completed in September 2003. This paper reports on the current progress of the study and identifies future direction.

## Extended Abstract

The Characterization of the Georgia Basin/Puget Sound Airshed provides a clear and comprehensive analysis of the past and present air quality conditions within the Georgia Basin/Puget Sound Air Basin. Clearly identifying the impacts on ambient air quality conditions within the Basin resulting from policy and planning strategies and natural processes.

The area of study shown in Figure 1 (area outlined in red) encompasses the many watersheds of the Georgia Basin/Puget Sound region. This study deals with two areas; the northern area identified as the Georgia Basin that includes Whatcom County, Greater Vancouver and Fraser Valley Regional Districts as well as portions of eastern Vancouver Island; the southern area, Puget Sound, is the remainder of the airshed. These areas are linked through the southern Haro Strait where low level winds transport air north and south between airsheds.

Meetings among officials from Environment Canada, the U.S. Environmental Protection Agency, the B.C. Government, the State of Washington, the Greater Vancouver Regional and the Fraser Valley Regional Districts and from First Nations and Tribes have started to develop a comprehensive international air quality strategy for the Georgia Basin/Puget Sound region (see Figure 1). One of the products of these meetings is a Statement of Intent that describes activities deemed to be of high priority for international air quality planning. A priority activity is the Characterization of the Georgia Basin/Puget Sound Airshed. The focus of this Characterization is on ground level ozone, fine particulate and visibility. These three components of the air quality picture fit very well with the immediate policy needs within the airshed. Policies being dealt with include the Regional Haze Rule, implementation of new ambient air quality standards for PM and Ozone (Canada Wide Standards), the Ozone Annex (2004) and a possible PM Annex (2005). In the Pacific Northwest, a number of electrical generating projects are being proposed with a few already under environmental review. Urban and suburban growth is an issue in many parts of the airshed. These issues require a more comprehensive understanding of atmospheric processes and impacts going beyond ground level ozone, fine particulate and visibility. This Characterization will provide a description of these air quality issues and their link to the broader social, health, and economic and environmental considerations.

## Sources of Air Pollutants

The sources of airborne pollutants are inventoried regularly by government agencies. These emission inventories assess and estimate the amount of pollution emitted to the atmosphere on an annual basis. The pollutants of interest are NO<sub>x</sub>, SO<sub>2</sub>, CO, O<sub>3</sub>, PM (PM<sub>10</sub> and PM<sub>2.5</sub>), VOC (volatile organ compounds), NH<sub>3</sub> and biogenics (natural emissions). These inventories are then analyzed to identify the relative importance of emissions in various areas of the airshed.



**Figure 1:** Georgia Basin and Puget Sound Airshed with national air quality measurement sites

The Puget Sound and Georgia Basin areas are quite similar when the relative magnitude of emissions is compared (Washington State Department of Ecology 2002; Greater Vancouver Regional District 2002). The actual tonnage of emissions is higher in Puget Sound (874 ktonnes, SMOG producing emissions) with higher population and industrial activities as compared with the Georgia Basin (259 ktonnes). The relative emissions of  $\text{NH}_3$  in the Georgia Basin are higher reflecting the agricultural components of this airshed whereas the emissions of biogenics in Puget Sound are higher indicating larger areas of natural vegetation. Otherwise emissions of the other pollutants are relatively comparable.

Changes in emission source strengths are forecast to assist planners and decision-makers in the management of the airshed. Emission forecasts are usually provided as part of an updated inventory. The forecasts for these airsheds identify significant decreases in  $\text{NO}_x$ , VOCs, and  $\text{PM}_{10}$  emissions from light duty vehicles over the next 20 years (Pollution Data Branch, Environment Canada 2001). However, overall trends show increases in  $\text{SO}_2$  and  $\text{NH}_3$ . Emission sources of concern include the marine sector, agriculture and more generally, population growth.

### **Air Quality and Meteorology**

Once the sources of the airborne pollutants have been identified and quantified, the transport, dispersion and then deposition of these emissions is the next piece that characterizes the airshed. Light winds, a stable atmosphere and sunshine, in the case of ozone, are meteorological conditions that lead to the elevated concentrations of atmospheric pollutants. Weather patterns that create these adverse conditions have been identified for the Pacific Northwest. The meteorological patterns that are conducive to produce high concentrations of ozone occurred 78 times in the past 15 years. Whereas, those conditions creating elevated  $\text{PM}_{10}$ , were observed 6 times which was identical to the frequency weather patterns causing elevated  $\text{PM}_{10}$  and ozone together.

Winds transport air pollutants between airsheds. The area to the south of Haro Strait or the most northern part of Puget Sound appears to be the “avenue” through which air pollutants can travel. Trajectories calculated for 12-hour durations ending at receptors in Puget Sound indicate pathways for air pollutants that extend well into the Georgia Basin, confirming the transborder transport (Washington State Department of Ecology 2002). The transpacific transport of air pollutants has also been documented with meteorological patterns creating wind flow that carry chemicals for several days ending at sites in both the Georgia Basin and Puget Sound (Jaffe et al 1999).

### **Air Quality Objectives and Standards**

The federal governments in Canada and the United States establish air quality guidelines, standards and objectives. State and Provincial jurisdictions along with some county and municipal jurisdictions set more stringent ambient air quality levels to ensure the air within the region is as clean as possible. These ambient concentration levels are used to assess the “well being” or “attainment” of various areas within the airshed. Areas in the Georgia Basin and Puget Sound are within these preset levels. Concentrations of ozone are however very close to the objectives and standards at several locations. It is interesting to note that those communities that are close to the ozone standards are not the major centers but some distance removed in a “down-wind” direction. For  $\text{PM}_{2.5}$ , of concern to both human health and visibility, concentrations are well within the standards but occasionally exceed the ambient concentrations believed to be important for human health impact.

### **Summary**

The “characterization” of the Georgia Basin/Puget Sound is a work in progress therefore conclusions are not appropriate at this time. However, there are statements that can be made about the nature of this very complex and growing area. The marine sector is an important emission source in the Georgia Basin with emissions expected to increase over the next few decades whereas the agriculture sector emissions are important in both airsheds with increasing ammonia emissions expected in the future. Population growth and the associated emission levels are important and will increase in both areas. Air pollutants are transported from one airshed to the other with atmospheric pollution also entering both airsheds from sources far to the south and west. A combination of complex topography and a growing population will present challenges to planners and decision-makers tasked with the strategic management of the Georgia Basin/Puget Sound airshed.

## References

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